

551, 355

## (12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
20 January 2005 (20.01.2005)

PCT

(10) International Publication Number  
**WO 2005/005320 A1**

(51) International Patent Classification<sup>7</sup>: **C01G 21/02**

(21) International Application Number:  
PCT/KR2003/001528

(22) International Filing Date: 30 July 2003 (30.07.2003)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:  
10-2003-0047458 11 July 2003 (11.07.2003) KR

(71) Applicant (for all designated States except US): **IBULE PHOTONICS CO., LTD.** [KR/KR]; 1276-10, Jeongwang-Dong, Siheung-Si, Kyunggi-Do 429-450 (KR).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **LEE, Sang-Goo** [KR/KR]; 508-305, Jugong Apartment, 1844 Jeongwang-Dong, Siheung-Si, Kyunggi-Do 429-450 (KR). **KIM, Min-Chan** [KR/KR]; 204-502, Ildo Woosung Apartment, 113-6, Ildo2-Dong, Jeju-Si, Jeju-Do 690-012 (KR). **CHOI, Byung-Ju** [KR/KR]; 109-401 Yeonsu2 Apartment, Yeonsu-Dong, Yeonsu-Gu, Incheon-Si

406-110 (KR). **SHIN, Min-Chul** [KR/KR]; 8/8, 39-17, Songpa-Dong, Songpa-Gu, Seoul 138-170 (KR). **YU, Su-Han** [KR/KR]; 564-1, Nonhyeon-Dong, Namdong-Gu, Incheon-Si 405-850 (KR).

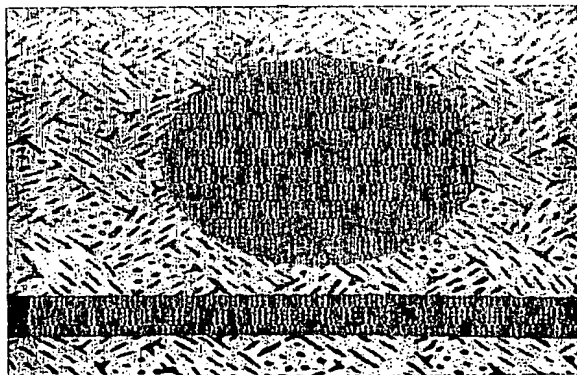
(74) Agent: **CHUNG, Jong-Ok**; Dong Won Patent & Trade-mark Law Firm, 12th Fl., Hyundai Jeonwon Officetel, 1589-7, Socho-Dong, Socho-Gu, Seoul 137-070 (KR).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: A FERROELECTRIC CERAMIC COMPOUND, A FERROELECTRIC CERAMIC SINGLE CRYSTAL, AND PREPARATION PROCESSES THEREOF



(57) Abstract: The present invention relates to a ferroelectric ceramic compound having the composition of the following formula:  $s[L]-x[P]y[M]z[N]p[T]$ , a ferroelectric ceramic single crystal, and preparation processes thereof. The ferroelectric ceramic compound and the single crystal according to the present invention are relaxor ferroelectrics having high piezoelectricity, a high electromechanical coefficient and a high electrooptical coefficient, and are useful for manufacturing tunable filters for radio communication, optical communication devices, surface acoustic wave devices, and the like. Particularly, the process of preparing the single crystal according to the present invention enables preparation of a single crystal having a diameter of 5 cm or greater and a single crystal wafer with uniform composition. In the formula, [P] is lead oxide, [M] is magnesium oxide or zinc oxide, [N] is niobium oxide, [T] is titanium oxide, [L] is one selected from the group consisting of lithium tantalate or lithium niobate, lithium, lithium oxide, platinum, indium, palladium, rhodium, nickel, cobalt, iron, strontium, scandium, ruthenium, copper, yttrium, and ytterbium or mixtures thereof, and x, y, z, p and s are defined as  $0.55 < x < 0.60$ ,  $0.09 < y < 0.20$ ,  $0.09 < z < 0.20$ ,  $0.01 < p < 0.27$  and  $0.01 < s < 0.1$ , respectively.

WO 2005/005320 A1



**Published:**

— with international search report

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*